THE EATING DISORDER EXAMINATION QUESTIONNAIRE: FACTOR STRUCTURE AND CONVERGENT VALIDITY OF THE CROATIAN BRIEF VERSION

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The Eating Disorder Examination Questionnaire (EDE-Q) is one of the most widely used self-reporting methods for assessing the behaviors and attitudes associated with eating disorders. Since recent studies have proposed alternative and shorter forms of the EDE-Q, the aim of this study is to compare the factor structure of the full-length version of the EDE-Q with several proposed models. A total of 600 participants (80.2% women) aged 18 to 52 years participated in the study. Among the four tested models, the abbreviated version of the questionnaire (EDE-Q7) showed the best fit for the data. The total score on the EDE-Q7 was highly correlated with the total score on the EDE-Q28 and the Eating Attitudes Test-26 (EAT-26), indicating good convergent validity. The findings indicate that the EDE-Q7 is a psychometrically acceptable and effective measure that can be used to assess symptoms of eating disorder behaviors in the Croatian community sample.

Keywords: Eating Disorder Examination Questionnaire (EDE-Q); Eating Attitudes Test (EAT-26); Eating pathology; Confirmatory factor analysis; Croatian translation.

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The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994) is a self-assessment questionnaire based on EDE interviews created in 1993 (Fairburn & Cooper, 1993). The EDE-Q is one of the most broadly used self-reporting methods to assess behaviors and attitudes associated with eating disorders (Fairburn & Beglin, 1994, 2008). It can be used when interviews are not feasible or cannot be conducted (Berg et al., 2012; Fairburn & Beglin, 1994). The EDE-Q, comprising four subscales (restraint, eating concern, shape concern, and weight concern), provides an assessment of the psychopathology of eating disorders and produces a summary of both attitudinal (e.g., concerns about weight) and behavioral (e.g., binge eating) symptoms.

The EDE-Q is used worldwide to assess the symptoms of eating disorders and eating psychopathology. It has been translated into a number of languages such as Turkish (Yucel et al., 2011), Spanish (Peláez-Fernández et al., 2012), Portuguese (Machado et al., 2014), Italian (Calugi et al., 2017), Persian (Mahmoodi et al., 2016), German (Kliem et al., 2017), Japanese (Mitsui et al., 2017), Hebrew (Zohar et al., 2017), and Lithuanian (Baceviciene et al., 2020), and used in clinical and nonclinical samples for both men and women (e.g., Grilo et al., 2015; Penelo et al., 2013) of different ages (e.g., Kliem et al., 2017) and cultures (e.g., He et al., 2021, China; Mohd Taib et al., 2021, Malaysia; Penelo et al., 2013, Mexico).

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The factor structure of the EDE-Q was verified several times using confirmatory and exploratory factor analysis in clinical and nonclinical samples, in English, and other languages in which it was translated (Barnes et al., 2012; Becker et al., 2010; Grilo et al., 2010, 2013, 2015; Machado et al., 2020; Peterson et al., 2007). Invariance based on gender and ethnicity was also assessed. The results obtained are often contradictory and the original 4-factor structure is not always confirmed.

In the last 10 years, abbreviated versions of the EDE-Q have been constructed and published. Using confirmatory factor analysis (CFA), shortened 7-item (Grilo et al., 2013), 8-item (Kliem et al., 2016), and in the last few years, 12-item (He et al., 2021), 13-item (Lev-Ari et al., 2021), and 18-item (Carey et al., 2019) versions have been created. There are numerous advantages to using short versions. In addition to saving time in application and scoring, it should be emphasized that the ability to monitor the outcome of treatment becomes more efficient, as well as the monitoring of patients from session to session. It is important to emphasize that in a rapid assessment of the psychopathology of eating disorders, short versions are extremely useful for both nonclinical and clinical screening (Machado et al., 2020). In the assessment of people with symptoms of eating disorders, it is often the case that the use of a large number of questionnaires creates fatigue in the respondents who believe they are being asked similar questions; this, in turn, leads to decreased motivation, inconsistent responses, withdrawal, or reduced quality of the data collected. In the process of shortening the questionnaire, it is necessary to take into account the quality of the content from the perspective of the patient or research participant (Rolstad et al., 2011). In a recent study, Machado et al. (2020) found that for nonclinical and clinical samples, including studies of treatment change and outcome, the short forms of the EDE-Q can be used as a good alternative when there is a requirement to rapidly screen for eating disorder psychopathology or to perform treatment monitoring.

Although eating disorders have been studied in Croatia for many years, exact data regarding their prevalence are not readily available. One reason for this is the lack of an accurate database and institutions dealing with eating disorders. Patients are treated within general and university hospitals, but also in private clinics and counseling centers, so it is difficult to obtain accurate information on the overall number of patients. According to some estimates, approximately 40,000 people in Croatia suffer from eating disorders (Sajko et al., 2015). Data from the Croatian Institute of Public Health from 2018 show the leading causes of hospitalization related to mental disorders in Croatia in the 10-19-year age range. Eating disorders are the fourth highest cause of hospitalization, following depressive disorders, and constitute 8.8% of hospitalized children and adolescents (Croatian Institut of Public Health, 2018). Another problem is the lack of instruments for adequate assessment of eating disorder symptoms and psychopathology. These data clearly point toward the increased need to adapt the well-established measures used in other European countries and worldwide into the Croatian language.

In Croatia, a small European country in transition, we did not have a translated version of the EDE-Q available for a long time, despite the common occurrence of eating disorders. Some studies have shown that the prevalence of eating disorders in Croatia is similar to that in other European countries (e.g., Knez et al., 2008; Pokrajac-Bulian et al., 2007). Research published by Prnjak and Jukic (2021) marked the beginning of the use of the EDE-Q in Croatia. While the Croatian version of the EDE-Q has satisfactory convergent validity, its construct validity is less than optimal (Prnjak & Jukic, 2021). When compared to the other tested models (with fewer factors or items), the original 4-factor structure was statistically better supported, however this model data fit was not completely in accordance with the recommended fit indices (Hu & Bentler, 1999). In their critical review of the obtained results, Prnjak and Jukic (2021) emphasized that the sample consisted of university students which, together with the fact that the majority of the sample were women, limits the generalization of the results.

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The latest version of the EDE-Q (Version 6.0) was translated into Croatian by Prnjak and Jukic (2021). Therefore, we examined the validity and reliability (test-retest reliability, McDonald's omega, and Cronbach's alpha) of this questionnaire in a community sample of men and women of a wider age range. We also evaluated several models, as suggested by Machado et al. (2020) in their review of short versions of the EDE-Q.

METHOD

Participants

A total of 600 participants aged 18 to 52 years ($M = 24.93$, $SD = 7.72$) participated in the study. Of the total sample, women represented 80.2% ($n = 481$). Thirty two percent of the participants were between 18 and 20 years, 43% were between 21 and 25 years, 7% between 26 and 30 years, and 18% were 31 and older. The participants had an average body mass index (BMI) of 23.03 ($SD = 3.92$) based on self-reported weight and height.

A subsample of 130 participants (116 women and 14 men) was included in the evaluation of the test-retest reliability of the EDE-Q after two weeks. The age range was from 18 to 27 years ($M = 21.15$, $SD = 2.02$), and their average BMI was 22.03 ($SD = 3.10$).

Instruments

The Eating Disorder Examination Questionnaire (EDE-Q 6.0; Fairburn & Beglin, 2008) examines behaviors and symptomatology related to eating disorders over the last 28 days. It contains 28 items and additional questions about height, weight, and for women questions about the absence of menstruation and the use of contraceptive pills. Of the 28 items mentioned, 22 were arranged in four subscales, and the remaining six examined the frequency of behaviors, such as intentional vomiting, taking laxatives, excessive exercise, and other similar behaviors.

The four subscales were: restraint, eating concern, weight concern, and shape concern. Three of the subscales contain five items each, — item samples, restraint "On how many of the past 28 days have you been deliberately trying to limit the amount of food you eat, to influence your shape or weight (whether or not you have succeeded)?"; eating concern "Over the past 28 days, how concerned have you been about other people seeing you eat?"; weight concern "On how many over the past 28 days... how dissatisfied have you been with your weight?" —, while shape concern contains eight items, for example "On how many of the past 28 days has thinking about shape or weight made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?" The shape concern and weight concern subscales use the same item to calculate the results, which is why the total number for calculating the results is 22 instead of 23 items. For most questions, it is necessary to indicate the number of days (in the past four weeks) in which a certain behavior was present (divided into seven categories, from *no days* to *every day*). Six questions required participants to enter the exact number of days or the correct number of times that particular behaviors occurred, while on the last seven questions, participants rated the severity of eating disorder symptoms on a scale from 0 (*not significant at all*) to 6 (*markedly*). Internal consistency coefficients reported in the literature ranged from .70 to .93 for subscales, while test-retest reliability are between .66 and .94, depending on the sample of subjects and the time span (Berg et al., 2012; Prnjak & Jukic, 2021).

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Participants also completed the Eating Attitudes Test (EAT-26; Garner & Garfinkel, 1979), which consists of 26 items assessing different attitudes and behaviors related to anorexia and bulimia nervosa. The total result was determined by summing up the subjects' responses on the scale ranked from 1 to 6. For each question, the most symptomatic response was recoded as a score of 3, the next most symptomatic 2, and the next 1. The remaining three options received a score of 0. The results on this scale range from 0 to 78, and a score above 20 is considered critical. The EAT-26 contains three factors: (1) dieting (related to an avoidance of fattening foods and a preoccupation with being thinner), (2) bulimia and food preoccupation (related to thoughts about food and bulimic behaviors), and (3) oral control or restriction (related to self-control about eating and the perceived pressure from others to gain weight) (Garfinkel & Newman, 2001; Garner et al., 1982). The psychometric properties of EAT were satisfactory, it had good sensitivity and specificity, in the sense that it could accurately demonstrate the proportion of people with and without the disorder who are correctly identified (Garner et al., 1982). The questionnaire was translated and used with Croatian samples of respondents, including a sample of primary school, high school, and university students. The 3-factor structure of the questionnaire was confirmed: dieting, bulimia and food preoccupation, oral control and social pressure (Ambrosi-Randić & Pokrajac-Bulian, 2005). The most common way of using this instrument is as a global measure, representing a good measure of abnormal behaviors and eating habits.

Procedure

The research was conducted in two ways: in classical paper-and-pencil form ($n = 239$) and online via Google Forms ($n = 361$). The questionnaires in paper-and-pencil form had been completed in January 2020. In this part of the research, participants filled out questionnaires during their regular classes at the university. In order to evaluate a test-retest reliability of EDE-Q, after two weeks' time, a subsample of 130 students again completed the paper version of EDE-Q, on campus. Because of the Coronavirus pandemic and the subsequent lockdown, we continued with online questionnaires. The invitation to participate in the study was announced on social networks and participants were recruited using the snowball method. We sent out invitations to the email addresses with a request to send forward the link to the questionnaire. An informed consent form was included, which explained the aim of the study, anonymous and voluntary nature of participation, and right to decline. No financial or academic reward was provided. This study was part of a project that was reviewed and approved by the University of Rijeka.

Data Analyses

In the first step of data analysis, the factor structure of the EDE-Q questionnaire was examined using confirmatory factor analysis to test and compare several models. (i) The original 4-factor model, which assumes four correlated factors (EDE-Q28; Fairburn & Beglin, 2008), with four factors: restraint, eating concern, weight concern, and shape concern. (ii) A 3-factor model (EDE-Q18; Carey et al., 2019), which assumes three correlated factors: restraint, weight and shape concern, preoccupation and concerns about eating. (iii) A single-factor model (Pennings & Wojciechowski, 2004), which assumes that all 28 items are saturated with one factor. (iv) An abbreviated 3-factor model (EDE-Q7; Grilo et al., 2013), which assumes three correlated factors: dietary restraint, shape/weight overvaluation, and body dissatisfaction.

Since the female participants in our study substantially outnumbered male participants, we were not able to test for measurement invariance. According to Yoon and Lai (2018), if the sample size in one group is twice the size of the other group, the results of factorial invariance testing will be invalid. With the increase of the sample size difference, the error of the fit statistics will be larger, suggesting a wrong conclusion about the fit of the tested models. Therefore, instead of testing for measurement invariance, we conducted separate CFAs on male and female subsamples.

After testing the factor structure, we examined the internal consistency using two coefficients: Cronbach's alpha (Cronbach, 1951) and McDonald's omega (McDonald, 2013). When calculating Cronbach's alpha coefficient, it is assumed that all items are equally saturated with the factor, which is not the case here; therefore, the omega coefficient is a more appropriate indicator of reliability (Dunn et al., 2014). In addition, we calculated the test-retest reliability on a smaller subsample of participants. Finally, we calculated descriptive indicators for subscales and total scores and their intercorrelations and correlations with the results of the Eating Attitudes Test (EAT-26). All analyses were performed using R (lavaan packages, Rosseel, 2012; semTools, Jorgensen et al., 2022) and JASP (2020) software.

RESULTS

We examined the construct and convergent validity of the EDE-Q and calculated the basic descriptive parameters, reliability, and sensitivity of the subscales and total score.

Factor Structure of the EDE-Q

CFA was used to assess the factorial structure of the EDE-Q. The maximum likelihood (ML) method was chosen as the model estimation method. Model fit was evaluated based on a combination of standard compliance indicators according to established criteria (RMSEA < .08; CFI and TLI > .90; SRMR < .09; Weston & Gore Jr, 2006). The results of the CFA are presented in Table 1.

TABLE 1
Results of the CFA on total sample and for female and male subsamples

Model	χ^2 p	df	RMSEA [90% CI]	CFI/TLI	SRMR
(i) 4-factor original (EDQ-28)					
Total	1914.83 < .001	202	.120 [.115, .125]	.829/.805	.074
Female	1226.196 < .001	182	.111 [.105, .117]	.860/.838	.072
Male	514.40 < .001	182	.125 [.113, .138]	.786/.753	.096

(table 1 continues)

Table 1 (continued)

Model	χ^2 p	df	RMSEA [90% CI]	CFI/TLI	SRMR
(ii) 3-factor (EDE-Q18)					
Total	1339.52 < .001	132	.125 [.119, .131]	.848/.823	.076
Female	730.001 < .001	116	.106 [.099, .113]	.892/.874	.076
Male	309.611 < .001	116	.120 [.104, .136]	.831/.801	.107
(iii) 1-factor (EDE-Q28)					
Total	3812.23 < .001	350	.131 [.128, .135]	.681/.655	.087
Female	3135.301 < .001	350	.132 [.128, .136]	.694/.669	.087
Male*	1249.39 < .001	324	.159 [.15, .168]	.527/.488	.116
(iv) 3-factor (EDE-Q7)					
Total	91.38 < .001	11	.111 [.091, .132]	.974/.950	.026
Female	78.873 <.001	11	.114 [.091, .138]	.973/.948	.025
Male	32.07 < .001	11	.127 [.077, .180]	.962/.928	.038

Note. Total N = 600; Female n = 481; Male n = 119; RMSEA = root-mean-square error of approximation; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root-mean-square residual. * Analysis was done on 27 items. Item 17 was excluded from analysis due to lack of variance (all participants answered 0 on the question).

None of the four tested models satisfied all the model fit criteria (the model-assumed variance/co-variance matrix differed significantly from the observed one). Nevertheless, among the tested models, the abbreviated version of the questionnaire (EDE-Q7) showed the best fit for the data. This model contains seven items distributed across three correlated factors: dietary restraint, shape/weight overvaluation, and body dissatisfaction. However, even for that model, the value of the RMSEA indicator exceeded the desired value but was the lowest compared to the values in the remaining three tested models. Similar patterns for the fit indices were obtained for the total sample and the subsamples.

Standardized factor loadings are shown in Table 2 and confirm the findings obtained in previous studies, according to which this is a valid and reliable instrument (Carrard et al., 2015; Grilo et al., 2010, 2013, 2015). All loadings were high and significant. The correlations between the factors were positive and moderate to high, with the correlation between factors 2 and 3 being very high, suggesting a possible overlap between these two factors. This result is in agreement with previous research (e.g., Grilo, 2014), according to which the factors of overestimation of body weight/shape and dissatisfaction with the body were also highly correlated (.75, p < .01). However, the authors state that this correlation is lower than that in the original

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questionnaire (ranging from .70 to .92), and has less overlap and redundancy. The correlation between the total score on EDE-Q28 and EDE-Q7 was .83, indicating that, in terms of psychometric properties, the short form of the EDE-Q was comparable to the original long form of the instrument. Machado et al. (2020) report Pearson's (r) correlation coefficients between the EDE-Q full-length version and derived short forms to have large and positive magnitudes of associations, ranging from .92 (EDE-Q7) to .99 (for the EDE-Q18).

TABLE 2
Standardized factor loadings for the EDE-Q7

Items			
Factor 1 (dietary restraint): "On how many of the past 28 days …..."			
1. have you been deliberately trying to limit the amount of food you eat, to influence your shape or weight (whether or not you have succeeded)?			.87
3. have you tried to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded)?			.73
4. have you tried to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you have succeeded)?			.86
Cronbach's alpha			.86
McDonald's omega			.86
Factor 2 (shape/weight overvaluation): "On how many over the past 28 days …..."			
22. has your weight influenced how you think about (judge) yourself as a person?			.96
23. has your shape influenced how you think about (judge) yourself as a person?			.92
Cronbach's alpha			.94
McDonald's omega			.94
Factor 3 (body dissatisfaction): "On how many over the past 28 days …..."			
25. how dissatisfied have you been with your weight?			.88
26. how dissatisfied have you been with your shape?			.90
Cronbach's alpha			.89
McDonald's omega			.89
Factors' intercorrelations	1	2	3
(1) Dietary restraint	–	.45[***]	.50[***]
(2) Shape/weight overvaluation		–	.82[***]
(3) Body dissatisfaction			–

Note. The Eating Disorder Examination Questionnaire (EDE-Q 6.0; Fairburn & Beglin, 2008) is under copyright and the items should not be used without permission. The authors of this article received the permission to reproduce up to 10 items.
[***]$p < .001$.

Internal Consistency and Test-Retest Reliability

Both reliability indicators (alpha and omega, Table 2) had satisfactory levels, as expected, based on previous research (Grilo, 2014; Grilo et al., 2013). The EDE-Q was administered to 130 participants at Time 1 (initial assessment) and again 14 days later (Time 2, admission). The test-retest reliability of the global

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EDE-Q7 score was .95, indicating evident stability of the estimates over time. The test-retest reliability co-efficients of the individual subscales were also high (range from .88 to .93).

Descriptive Indicators and Convergent Validity of Short EDE-Q

The basic descriptive indicators of the subscales of the abbreviated version of the EDE-Q are presented in Table 3.

TABLE 3
Basic descriptive indicators of the subscales of short EDE-Q

	k	Min	Max	M	SD	Skewness	SE	Kurtosis	SE
Dietary restraint	3	0	6	1.50	1.71	1.15	0.10	0.28	0.20
Shape/weight overvaluation	2	0	6	2.48	1.78	0.47	0.10	–0.82	0.20
Body dissatisfaction	2	0	6	2.70	1.75	0.34	0.10	–0.95	0.20
EDE-Q7 total	7	0	6	2.12	1.43	0.63	0.10	–0.38	0.20

Note. k = number of items; M = mean; SD = standard deviation; SE = standard error.

From the descriptive data, it can be seen that the three subscales covered the entire scale range, but the average values were slightly shifted to the left. The skewness index shows that the subscales were symmetrical (Kline, 2015).

We tested the convergent validity of the short version of the EDE-Q by calculating its correlation with the total score on the EAT-26. The correlations were significant and high: .61 for the dietary restraint subscale, .64 for shape/weight overvaluation, and .63 for body dissatisfaction. The obtained correlations support the good convergent validity of the abbreviated version of the EDE-Q for examining the symptoms of eating disorders and are in line with the results of previous research (Peláez-Fernández et al., 2012).

DISCUSSION

The purpose of this study was to analyze the applicability of the EDE-Q to a sample of men and women of a wider age range, and to assess its validity and reliability. Based on a literature review of the used forms of the EDE-Q scale, we compared several models: the original 4-factor model (EDE-Q28; Fairburn & Beglin, 2008), with four correlated factors: restraint, eating concern, weight concern, and shape concern; a 3-factor model (EDE-Q18; Carey et al., 2019), which suggests three correlated factors: restraint, weight and shape concern, preoccupation and concerns about eating; a single-factor model (Pennings & Wojciechowski, 2004), which assumes that all 28 items are saturated with one factor; and an abbreviated 3-factor model (EDE-Q7; Grilo et al., 2013), which proposes three correlated factors: dietary restraint, shape/weight overvaluation, and body dissatisfaction. The models were tested separately for male and female subsamples because of the large gender imbalance in the sample. Although none of the four tested models satisfied all model fit criteria, the abbreviated version of the questionnaire showed the best fit to the data.

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A 3-factor model for the EDE-Q7, with subscale scores for dietary restraint, body dissatisfaction, and shape and weight overvaluation, had the best fit indices compared with the other tested models. This factor structure replicated the factor structure of the EDE-Q7 proposed by Grilo et al. (2013) and Machado et al. (2020). The major advantage of EDE-Q7 is that it is short, user friendly, and parsimonious.

The EDE-Q7 also showed good convergent validity. Participants who reported higher levels of dietary restraint, shape/weight overvaluation, and body dissatisfaction tended to have significantly higher levels of eating disorder symptoms, as measured by the EAT-26. The relatively large correlation ($r = .76$) between the total scores of EDE-Q7 and eating disorder psychopathology, as measured by the EAT-26, is similar to the findings of previous studies. For example, in a general sample of Chinese undergraduate students, He et al. (2021) found a correlation of .56 between the EDE-QS and EAT-26, and in an Australian community sample, Hughes et al. (2016) found a correlation of .58.

The present study showed that the EDE-Q7, in general, is a psychometrically acceptable instrument for assessing the symptoms of eating disorder behaviors in a Croatian community sample. A major advantage of the shorter version is that it is less time-consuming and does not inconvenience the patients or clients. This is particularly relevant when conducting a comprehensive survey to assess the psychological and physical impact of an eating disorder, as well as its risk factors and symptoms (He et al., 2021) in the Croatian context. Furthermore, EDE-Q7 can be useful for studying the epidemiology of eating disorders in Croatia, for assessment and routine outcome monitoring, as well as for conducting research in the field. However, prior to administering the questionnaire to Croatian individuals with different eating disorders, it is necessary to re-examine its psychometric properties (Prnjak & Jukic, 2021).

The present study has several limitations. First, the participants were predominantly women (80.2%), which may limit the generalizability of our findings to men. In this regard, further research is warranted to examine the psychometric properties of the EDE-Q7 with more representative Croatian male samples. Second, the sample had a wide age range, although most respondents were in the 18- to 32-year age group. Research shows certain changes with aging, but these are also dependent on BMI. For example, Rø et al. (2012) indicated that EDE-Q scores declined with age but increased with BMI. An exception to these results was purging behavior frequency, which did not show significant differences across age groups or weight status. Likewise, dietary restraint scores did not differ by age. Third, our sample was community and nonclinical. Although assessing the suitability of the EDE-Q in nonclinical populations is useful, since its usage may provide information about disordered eating behaviors ahead of the occurrence of adverse health outcomes (Bentley et al., 2014), the EDE-Q7 could also serve as a useful instrument in clinical settings, as already shown by some other shorter forms of the EDE-Q questionnaire (e.g., Gideon et al., 2016), especially for assessing session-by-session outcomes.

Further validation of the EDE-Q7 should also focus on the item response theory, to better investigate the psychometric properties of individual items (He et al., 2021), especially the presence of differential item functioning (DIF) across gender groups. Future studies should assess the sensitivity of the EDE-Q7 questionnaire to identify changes that take place during the course of treatment. It is also necessary to establish clinically significant indices of change or cut-off scores (Gideon et al., 2016) for EDE-Q7 to distinguish between nonclinical and clinical impairments in eating disorders. This could be used to guide clinical treatment plans and help clinicians direct attention to the symptoms that are a priority for the individual patient.

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